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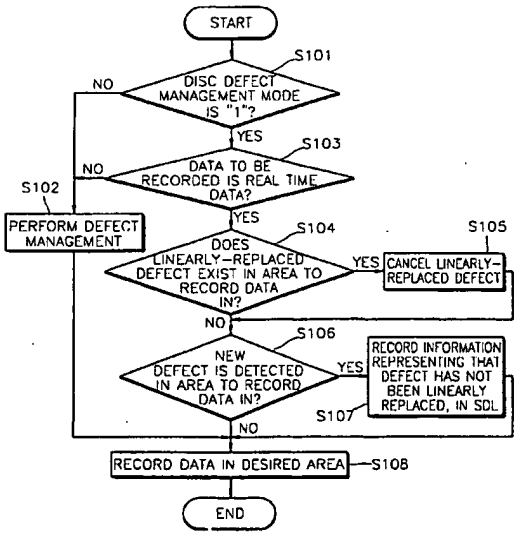
(54) Recording medium for storing defect management information for recording real time data, defect managing method therefor, and real time data recording method

(57) A recording medium for storing defect management information to record real time data, a defect managing method therefor, and a method of recording real time data, are provided. The recording medium stores information representing use or non-use of linear replacement defect management in which a defective area on the recording medium is replaced with the spare area, in order to record real time data. While maintaining compatibility between the defect managing method and a defect managing method based on a current DVD-RAM standard, i.e., while allowing report of the fact that there are blocks which have not been linearly replaced, linear replacement is not performed when real time data is recorded. Thus, real time data can be recorded and reproduced.

FIG. 9



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Description

[0001] The present invention relates to the field of managing a disk and its defects, and more particularly, to a recording medium for storing defect management information with respect to whether linear replacement is used, a method of effectively managing defects to record and/or reproduce video and/or audio data from a digital versatile disc random access memory (DVD-RAM) in real time, and a method of recording data in real time using defect management information.

[0002] Real time recording or reproduction means that a given amount of data is necessarily recorded or reproduced within a given time since input information is lost if it is not processed at the moment data is input, and since a phenomenon such as pause of an image or temporary interruption of music occurs with reproduction of data as abnormal information if data is not recorded or reproduced at a predetermined speed. The above-described problems are caused since the input of information cannot be temporally controlled by a recording and reproducing apparatus.

[0003] In the DVD-RAM standard version 1.0, a method of managing defects generated on a disk has been disclosed to increase the reliability of data recorded on the disk. Slipping replacement and linear replacement are included as the disclosed defect management method: the first method processes defects detected in an initializing process; and the second method replaces an error correction code (ECC) block unit (16-sector unit) including a sector having a defect generated during use of the disc with a defect-free ECC block in a spare area.

[0004] The slipping replacement is used to minimize a reduction in the recording or reproduction speed due to defects, in which a logical sector number to be provided to a defective sector is provided to a sector next to the defective sector detected during a certification process for investigating defects of a disc when the disc is initialized, that is, data is recorded or reproduced by slipping a sector on which a defect is generated during recording or reproduction. Here, a real physical sector number is pushed back by the sector number designated by slipping the defective sector. Such a left-behind phenomenon is solved by using as many sectors as there are defects in a spare area located at the end portion of a corresponding recording area.

[0005] However, the slipping replacement cannot be used for a defect generated while a disc is used. When a defective portion is disregarded and skipped, discontinuity is generated on logical sector numbering, which means that the slipping replacement violates file system rules. Thus, the linear replacement is used when a defect is generated during use of the disc, which means the replacement of an ECC block including a defective sector with an ECC block existing in a spare area.

[0006] When the linear replacement is used, no vacuum exists in a logical sector number, however, the position of a sector on a disc is discontinuous, and real data corresponding to a defective ECC block exists in the spare area.

[0007] As described above, when real time recording, in which the time for temporarily-input information cannot be arbitrarily delayed, such as, recording of broadcast information or a real image, is necessary, information is recorded in an area to be linearly-replaced by undergoing a process in which a real pickup goes up to the spare area and searches for an area to be linearly replaced, and a process in which the real pickup comes back. Hence, the recording speed is reduced, so that information input in real time cannot be continuously recorded when the linear replacement is used.

[0008] It is prescribed that a DVD-RAM drive according to the DVD-RAM standard version 1.0 processes all of this defect management to reduce the burden of the host computer used in the drive. The host computer is designed to transmit a command ordered not to manage defects to the drive using a command denoted in an interface standard. That is, if the host computer determines whether defect management will be performed, the defect management itself is supposed to be performed by the drive.

[0009] Even when the host computer does not manage defects according to the need of an application program, the DVD-RAM disc according to the DVD-RAM standard version 1.0 must necessarily manage defects recorded in a primary defect list (PDL) and a secondary defect list (SDL) according to a defect management rule if an area slipping replaced or linear replaced due to defect management performed by another drive exists. Here, it is prescribed that the position of a defective sector replaced according to slipping replacement should be recorded in the PDL, and the position of a defective block replaced according to linear replacement should be recorded in the SDL. That is, when data is recorded after setting the fact that a specific drive should not perform defect management using the linear replacement, it cannot be ensured that other drives must also not perform the linear replacement on the same disc.

[0010] Therefore, when real time recording is performed by a current DVD-RAM disc, it may be difficult because of an area to be used by the linear replacement.

[0011] With a view to solve or reduce the above problems, it is an aim of embodiments of the present invention to provide a recording medium for storing defect management information associated with whether linear replacement is used or not, to record real time data.

[0012] It is another aim to provide a recording medium for storing information for showing a plurality of different defect management modes according to the type of data to be recorded.

[0013] It is still another aim to provide a recording medium for allocating a spare area for only real time recording whose space can be effectively utilized.

[0014] It is yet another aim to provide a method of managing a defect of a recording medium which can

record real time data and can have maximum compatibility with a general DVD-RAM disc.

[0015] It is still yet another aim to provide a method of recording real time data using the defect management information associated with whether the linear replacement is used.

[0016] According to a first aspect of the invention, there is provided a defect managing method for a disc recording and/or reproducing apparatus, comprising the steps of:

(a) recording information representing use or non-use of linear replacement defect management with respect to an entire disc or a specific area of the disc on the disc; and

(b) determining whether a defective area of the disc is to be replaced by a block in a spare area of the disc using linear replacement according to the information representing use or non-use of the linear replacement defect management.

[0017] Preferably, said step (a) comprises recording the information representing use or non-use of linear replacement for the entire disc in a reserved area of a disc certification flag in a disc definition structure (DDS) of the disc, wherein the disc is a digital versatile disc-random access memory (DVD-RAM) disc.

[0018] Preferably, said step (a) comprises recording the information representing use or non-use of linear replacement for the specific area of the disc in a reserved area of a group certification flag in a disc definition structure (DDS) of the disc, wherein the disc is a digital versatile disc-random access memory (DVD-RAM) disc.

[0019] The defect managing method may further comprise the step of (a) recording the information representing use or non-use of linear replacement upon initialization of the disc.

[0020] The defect managing method may further comprise the step of (a) recording the information representing use or non-use of linear replacement just before real time data is recorded on the disc.

[0021] Preferably, the information representing use or non-use of linear replacement is information for showing a plurality of defect management modes, and is recorded in a reserved area of a disc definition structure (DDS) of the disc.

[0022] Preferably, the information showing the plurality of defect management modes includes information representing that slipping replacement and linear replacement are applied with respect to all data to be recorded in a user data area on the disc, information representing that linear replacement is selectively applied according to type of the data on the disc, and information representing that linear replacement is not applied to all the data to be recorded in the recording area on the disc.

[0023] Preferably, the information representing use or non-use of linear replacement indicates use of a defect managing method dedicated for real time recording in which linear replacement is not performed by allocating only a spare area for slipping replacement.

[0024] The spare area for slipping replacement is allocated to a last group of the disc, and the information representing use or non-use of linear replacement is recorded in a reserved area of each of a disc definition structure (DDS) and a primary defect list (PDL) of the disc.

[0025] Preferably, in said step (b) in response to the information representing use or non-use of linear replacement representing the non-use of linear replacement, the defect managing method comprises not using linear replacement for real time data to be recorded on the disc, and using linear replacement for data to be recorded on the disc other than the real time data.

[0026] Preferably, in step (b) in response to the information representing use or non-use of linear replacement represents the non-use of linear replacement, the defect managing method comprises not using linear replacement regardless of whether data to be recorded on the disc is real time data.

[0027] The defect managing method may further comprise the step of: (c) cancelling the linear replacement of a defect on an area of the disc where real time data is to be recorded, in response to the information representing use or non-use of linear replacement representing the non-use of linear replacement.

[0028] In step (c) linear replacement may be cancelled using a flag representing that the linear replacement has been cancelled using a reserved bit in a secondary defect list (SDL), storing information representing that the defective block has been replaced in a Forced Re-Assignment Marking (FRM) bit of the SDL, and storing a start sector number of the defective block and a start sector number of the replacement block in the SDL.

[0029] The defect managing method may further comprise the step of (c) leaving only a start sector number of the defective block in a secondary defect list (SDL), storing information representing that the defective block has not been replaced in a Forced Re-Assignment Marking (FRM) bit of the SDL showing whether the defective block has been replaced, and storing information representing that the defective block has not been replaced in a start sector number of the replacement block in the SDL.

[0030] The defect managing method may further comprise the step of: (c) recording only a start sector number of the defective block having a defect generated while using the disc on which the information that the linear replacement defect management will not be used has been recorded, in a secondary defect list (SDL), recording information representing that the defective block has not been replaced in a Forced Re-Assignment Marking (FRM) bit of the SDL showing whether the defective block has been replaced, and recording information that the defective block has not been replaced in a start sector number of the replacement block in the SDL.

[0031] The defect managing method may further comprise the step of: (c) performing defect management based on linear replacement when a defect is generated during use of the disc on which the information that the linear replacement defect management will be used has been recorded.

[0032] According to another aspect of the invention, there is provided a method of recording real time data while managing a defect on a disc using a disc recording and/or reproducing apparatus, the method comprising the steps of:

(a) determining whether defect management mode information representing whether defect management based on linear replacement is to be used;
(b) determining whether data to be recorded on a disc is the real time data, in response to the defect management mode information being information that the linear replacement not to be used;
(c) determining whether a linearly-replaced defect exists in an area of the disc in which the data is to be recorded, in response to the data to be recorded being the real time data; and
(d) determining whether a new defect is detected in the area in which to record the data, in response to no linearly-replaced defect existing in the area in which to record the data, and recording the real time data in a designated part of the area in which to record the data in response to the new defect not being detected.

[0033] The method of recording real time data may further comprise the steps of: (e) performing defect management in response to the defect management mode information being information representing that the linear replacement is to be used in said step (a); and (f) performing the defect management in response to the data to be recorded not being the real time data in said step (b).

[0034] The method may further comprise the step of: (e) cancelling linear replacement in response to the linearly-replaced defect existing in the area in which to record the data, in said step (c).

[0035] The method may further comprise the step of: (e) comprising the steps of leaving only a start sector number of a defective block in the SDL, storing information representing that the defective block has not been replaced in a Forced Re-Assignment Mark (FRM) bit of the SDL showing whether the defective block has been replaced, and recording information representing that the defective block has not been replaced in a start sector number of a replacement block in the SDL.

[0036] Step (e) may comprise the steps of setting a flag representing that linear replacement has been cancelled using a reserved bit of the SDL, storing information representing that a defective block has been replaced in a Forced Re-Assignment Mark (FRM) bit of the SDL, and recording a start sector number of a defective block and a start sector number of a replacement block in the SDL.

[0037] The method of recording real time data may further comprise the step of: (e) recording information representing that linear replacement has not been performed, in response to a new defect being detected in said step (d).

[0038] The method may further comprise the step of: (e) the steps of leaving only a start sector number of a defective block in the SDL, storing information representing that the defective block has not been replaced in a Forced Re-Assignment Mark (FRM) bit of the SDL showing whether the defective block has been replaced, and recording information representing that the defective block has not been replaced in a start sector number of a replacement block in the SDL.

[0039] Preferably, the disc is a digital versatile disc-random access memory (DVD-RAM) disc having a defect definition structure (DDS), and the defect management mode information is information representing use or non-use of linear replacement for the entire disc, and is stored in a reserved area of a disc certification flag in the DDS.

[0040] Preferably, the disc is a digital versatile disc-random access memory (DVD-RAM) disc having a defect definition structure (DDS), and the defect management mode information is information representing use or non-use of linear replacement for only some data groups of the disc, and is stored in a reserved area of a group certification flag in the DDS.

[0041] Preferably, the defect management mode information includes information representing that slipping replacement and linear replacement are applied to all the data to be recorded on the disc, information representing that linear replacement is selectively applied according to type of data, or information representing that linear replacement is not applied to all the data to be recorded on the disc, and the defect management mode information is stored in a reserved area of the DDS.

[0042] Preferably, the disc is a digital versatile disc-random access memory (DVD-RAM) disc having a defect definition structure (DDS) and a primary defect list (PDL), and the defect management mode information is information representing the use of a defect managing method for only real time recording in which linear replacement is not used by allocating only the spare area for slipping replacement, and is stored in a reserved area of the DDS and a reserved area of the PDL.

[0043] According to one aspect of the invention, there is provided a recording medium including a recording area and a spare area, for storing information representing use or non-use of linear replacement defect management in which a defective area on the recording medium is replaced with the spare area.

[0044] Preferably, the information representing use or non-use of linear replacement contains information associated with the entire recording medium.

[0045] The information representing use or non-use of linear replacement preferably contains information associated with parts of the recording medium.

[0046] The recording medium may be a disc designated by a digital versatile disc (DVD) standard.

The recording medium may be a DVD-RAM disc designated by a DVD-RAM standard.

[0047] The information representing use or non-use of linear replacement is preferably recorded in a reserved area of a disc certification flag and a group certification flag in a disc definition structure (DDS) provided by the DVD-RAM.

[0048] The information representing use or non-use of linear replacement is preferably stored upon initialization. The information representing use or non-use of linear replacement may be stored just before recording the real time data.

[0049] Preferably, only the start sector number of a block having a defect generated while real time data is recorded on the recording medium is recorded in a secondary defect list (SDL), information representing that the defective block has not been replaced is recorded in an FRM bit of an SDL entry for representing replacement or non-replacement of the defective block, and information representing non-replacement is recorded in the start sector number of a replacement block of the SDL entry.

[0050] Information representing that linear replacement has been cancelled may be further stored in a reserved bit of the SDL entry, information representing that the defective block has been replaced is stored in the FRM bit of the SDL entry, and the start sector number of the defective block and that of the replacement block are stored in the SDL entry.

[0051] The information representing use or non-use of linear replacement preferably includes information representing that linear replacement is applied with respect to every data on a recording medium, information representing that linear replacement is selectively applied according to the type of data, and information representing that linear replacement is not applied to every data on the recording medium, and this information is stored in the reserved area of the DDS.

[0052] When real time data is recorded, a spare area for linear replacement is preferably not allocated, and only a spare area for slipping replacement is allocated.

[0053] The spare area for slipping replacement is preferably allocated in the last group of the recording medium by the size of sectors capable of processing a maximum number of entries capable of registering a primary defect list (PDL).

[0054] Preferably, information representing use or non-use of linear replacement, denoting use of a defect managing method for only real time recording in which linear replacement is not used by allocating only the spare area for slipping replacement, is stored in a reserved area of the DDS and the PDL.

[0055] According to another aspect of the invention, there is provided a recording medium for storing defect management mode information for showing a plurality of defect management modes representing use or non-use of linear replacement according to the type of data to be recorded.

[0056] The defect management mode information may be stored in a reserved area of the DDS of a defect management area (DMA).

[0057] The defect management mode information preferably includes first defect management mode information representing that slipping replacement and linear replacement are applied to every data on the recording medium, second defect management mode information representing that linear replacement is selectively applied according to the type of data, and third defect management mode information representing that linear replacement is not applied to every data on the recording medium.

[0058] According to a further aspect of the invention, there is provided a recording medium for storing information representing non-application of linear replacement to all data on the recording medium in a defect management area, in which only a spare area for slipping replacement is allocated.

[0059] The defect management area is preferably a reserved area in the DDS and the PDL, and the spare area for slipping replacement can process a maximum number of entries capable of registering the PDL.

[0060] According to another aspect of the invention, there is provided a defect managing method for a disc recording and/or reproducing apparatus, comprising the steps of:

(a) recording information representing use or non-use of linear replacement defect management with respect to the entire disc or a specific area of a disc; and

(b) determining whether a defective area will be replaced by a block in a spare area using linear replacement according to information representing use or non-use of the linear replacement defect management.

[0061] Preferably, in step (a), information representing use or non-use of linear replacement for the entire disc is recorded in a reserved area of a disc certification flag in the DDS provided by the DVD-RAM.

[0062] Preferably, in step (a), information representing use or non-use of linear replacement for the specific area of the disc is recorded in a reserved area of a group certification flag in the DDS provided by the DVD-RAM.

Preferably, in step (a), the information representing use or non-use of linear replacement is recorded upon initialization of the disc. Alternatively, the information representing use or non-use of linear replacement may be recorded just before real time data is recorded on the disc.

[0063] The information representing use or non-use of linear replacement is preferably information for showing a plurality of defect management modes, and this information is recorded in a reserved area of the DDS.

[0064] Preferably, the information showing the plurality of defect management modes includes information representing that slipping replacement and linear replacement is applied with respect to all data on the recording medium, information representing that linear replacement is selectively applied according to the type of data, and information representing that linear replacement is not applied to all data on the recording medium.

[0065] The information representing use or non-use of linear replacement preferably denotes the use of a defect managing method dedicated for real time recording in which linear replacement is not performed by allocating only a spare area for slipping replacement.

[0066] The spare area for slipping replacement may be allocated to the last group of a disc, and the information representing use or non-use of linear replacement recorded in the reserved area of the DDS and the PDL.

[0067] Preferably, in step (b), when the information representing use or non-use of linear replacement represents the non-use of linear replacement, linear replacement is not used for real time data, but linear replacement is used for data other than real time data. In step (b), when the information representing use or non-use of linear replacement represents the non-use of linear replacement, linear replacement is preferably not used regardless of whether data is real time data.

[0068] The defect managing method may further comprise the step of: (c) cancelling the linear replacement of a defect on an area where real time data is to be recorded, when the information representing use or non-use of linear replacement represents the non-use of linear replacement.

[0069] In step (c), the linear replacement may be cancelled using a flag representing that the linear replacement has been cancelled using a reserved bit in an SDL, information representing that a defective block has been replaced is preferably stored in an FRM bit of the SDL entry, and the start sector number of the defective block and the start sector number of a replacement block may be stored in the SDL entry.

[0070] In step (c), preferably only the start sector number of a defective block is left in an SDL, information representing that a defective block has not been replaced is stored in an FRM bit of the SDL entry showing whether the defective block has been replaced, and information representing that the defective block has not been replaced is stored in the start sector number of a replacement block are stored in the SDL entry.

[0071] The defect managing method may further comprise the step of: (d) recording only the start sector number of a block having a defect generated while using a disc on which information that the linear replacement defect management will not be used has been recorded, in an SDL, recording information representing that a deflective block has not been replaced in the FRM bit of the SDL entry showing whether the deflective block has been replaced, and recording information that the deflective block has not been replaced in the start sector number of a replacement block in the SDL entry.

[0072] The defect managing method may further comprise the step of: (e) performing defect management based on linear replacement when a defect is generated during use of a disc on which information that the linear replacement defect management will be used has been recorded.

[0073] According to another aspect of the invention, there is provided a method of recording real time data while managing a defect on a disc using a disc recording and/or reproducing apparatus, the method comprising the steps of: (a) determining whether defect management mode information representing whether defect management based on linear replacement will be used; (b) determining whether data to be recorded is real time data, when the defect management mode information is information that the linear replacement will not be used; (c) determining whether a linearly-replaced detect exists in an area to record data in, when the data to be recorded is real time data; and (d) determining whether a new defect is detected in the area to record data in, when no linearly-replaced defect exists in the area to record data in, and recording the real time data in a desired area when the new defect is not detected.

[0074] The method of recording real time data may further comprise the steps of: (e) performing defect management when the defect management mode information is information representing that the linear replacement will be used, in step (a); and (f) performing defect management when data to be recorded is not real time data in step (b).

[0075] The method may further comprise the step of: (g) canceling linear replacement when a linearly-replaced defect exists in an area to record data in, in step (c).

Preferably, in step (g), only the start sector number of a defective block is left in the SDL, information representing that the defective block has not been replaced is stored in an FRM bit of the SDL entry showing whether the defective block has been replaced, and information representing that the defective block has not been replaced is recorded in the start sector number of a replacement block in the SDL entry.

[0076] Preferably, in step (g), a flag representing that linear replacement has been cancelled is set using a reserved bit of the SDL entry, information representing that a defective block has been replaced is stored in an FRM bit of the SDL entry, and the start sector number of the defective block and the start sector number of a replacement block are recorded in the SDL entry.

[0077] The method may further comprise the step of: (h) recording information representing that linear replacement has not been performed, when a new defect is detected in step (d).

[0078] Preferably, in step (h), only the start sector number of a defective block is left in the SDL, information representing that the defective block has not been replaced is stored in an FRM bit of the SDL entry showing whether the defective block has been replaced, and information representing that the defective block has not been replaced is recorded in the start sector number of a replacement block in the SDL entry.

[0079] The defect management mode information may be information representing use or non-use of linear replacement for the entire disc, and is stored in a reserved area of a disc certification flag in a DDS provided by DVD-RAM. Alternatively, the defect management mode information may be information representing use or non-use of linear replacement for some data groups of the disc, and stored in a reserved area of a group certification flag in a DDS provided by DVD-RAM.

[0080] The defect management mode information preferably includes information representing that slipping replacement and linear replacement are applied to all data on a disc, information representing that linear replacement is selectively applied according to the type of data, and information representing that linear replacement is not applied to all data on the disc, and this information is stored in a reserved area of a DDS provided by DVD-RAM.

[0081] The defect management mode information may be information representing the use of a defect managing method for only real time recording in which linear replacement is not used by allocating only the spare area for slipping replacement, and is stored in a reserved area of a DDS provided by DVD-RAM and the PDL.

[0082] For a better understanding of the invention, and to show how embodiments of the same may be carried into effect, reference will now be made, by way of example, to the accompanying diagrammatic drawings, in which:

Figure 1 is a view for explaining a defect management method using slipping replacement of a recording medium;

Figure 2 is a view for explaining a defect management method using linear replacement of a recording medium;

Figure 3 is a table of a defect definition structure (DDS) ;

Figures 4A and 4B illustrate the structures of the disc certification flag and the group certification flag shown in Figure 3, respectively;

Figure 5 is a table of the contents of a secondary defect list (SDL) ;

Figure 6 illustrates the structure of the spare area full flag shown in Figure 5;

Figure 7 illustrates the structure of the SDL entry shown in Figure 5;

Figures 8A and 8B illustrate the structures of the disc certification flag and the group certification flag of the DDS for recording real time data proposed by embodiments of the present invention, respectively;

Figure 9 is a flowchart illustrating an embodiment of a method of recording data according to a defect management method of the present invention;

Figure 10 illustrates an example of the structure of an improved SDL entry for canceling linear replacement as proposed by the present invention;

Figure 11 illustrates an example of a DDS for storing information for indicating a plurality of different defect management modes proposed by the present invention;

Figure 12 is a table showing allocated spare areas for recording real time data as proposed by embodiments of the present invention; and

Figure 13 illustrates a DDS and the structure of a primary defect list (PDL) for storing defect management mode information as proposed by embodiments of the present invention for allocating the spare areas for only real time recording shown in Figure 12.

[0083] Preferred embodiments of a recording medium storing defect management information for recording real time data, a defect managing method using the same, and a real time data recording method will now be described with reference to the attached drawings.

[0084] First, slipping replacement and linear replacement will be described in detail referring to Figures 1 and 2 in order to help in the understanding of the present invention.

[0085] Figure 1 is a view for explaining a defect management method using the slipping replacement. Physical addresses on a disc shown in Figure 1 are recorded as P1, P2, P3, ..., Pn, and logical addresses must be provided to record real data in this physically-segmented sector. These logical addresses act as addresses allowing a real file system to search for its own data. However, the relationship between the physical addresses and the logical addresses is made in a disc initialization process. If a defect is detected on the third physical sector P3 as shown in Figure 1, a logical address is not designated to this defective sector, and a logical sector number L3 is designated to the next physical sector P4. Then, the logical sectors are sequentially pushed back by the number of defective sectors, and a spare area

located at the end of a corresponding data group is used by the pushed portion. In this slipping replacement method, effective processing in sector units is possible by simply slipping a defective region, and a pickup does not need to move to a different place upon recording and reproduction by simply disregarding and skipping a defective portion. Thus, the defective region can be avoided while minimizing the delay time. Here, the position of a defective sector replaced by the slipping replacement is recorded in the PDL.

[0086] Figure 2 is a view for explaining a defect management method using linear replacement. In the linear replacement for processing defects generated while a disc is used after being initialized, the defects are managed in an ECC block unit, i.e., in units of 16 sectors. In other words, when an error is generated at a specific sector and a defect is thus detected, if the movement in units of at least 16 sectors is not made for error correction, the error correction unit of each data previously recorded in a disc must be changed. Thus, processing in an ECC block unit must be performed, and the slipping replacement method of slipping a defective sector and designating a logical sector cannot be used since the logical address of an area where data has already been recorded cannot be changed. When a defect is generated in a logical block LB3 as shown in Figure 2, the defective region is recorded in the SDL to be prevented from being used, and the defective portion is replaced with a usable block existing in a spare area. The replaced block (SBk in Figure 2) in the spare area has the same logical block number (LB3) as the erroneous block.

[0087] In a reproduction sequence, as shown in Figure 2, reading is continued just before to a defective block as in an area 1, a replaced ECC block existing in the spare area is read by moving a pickup or the like as in an area 2, and data is continuously read from a block right next to the defective block as in an area 3. In order to process defects as described above, pickup movement is caused such as a process for searching for data and a process for returning to the block right next to the defective block after reading the replaced block. Thus, much time is required to read or write data, so that this defect management is not appropriate for real time recording.

[0088] Figure 3 is a table of a disc definition structure (DDS) existing in a defect management area (DMA) of a DVD-RAM. In particular, a byte position (BP) 3, a disc certification flag, records the certified contents of the entire disc, and BPs 16 through 39, group certification flags, record the contents of certification of 24 data groups.

[0089] In addition, BPs 0 and 1 are DDS identifiers, and BPs 4 through 7 are the values of counters for updating DDS/PDL representing the total number of times in which a DDS/PDL block is updated and rewritten. That is, when initialization starts, the value of a counter is set to be "0", and increases by one whenever the DDS/PDL is updated or rewritten. All DDS/PDL and SDL blocks must have the same counter value after formatting is completed. BPs 8 and 9 denote the number of groups, and, for example, 24 groups are recorded as "0018" (hexadecimal).

[0090] Figure 4A illustrates the structures of the disc certification flag shown in Figure 3. When a bit b7 among three bits b7, b6 and b5 representing an in-process state is "0b" it indicates format completion, and when the bit b7 is "1b", it indicates an under-formation state. When the bit b6 is "0b", it indicates the progress of formatting using full certification, and when the bit b6 is "1b", it indicates the progress of formatting using partial certification. When the bit b5 is "0b", it indicates the progress of formatting on the entire disc, and when the bit b5 is "1b", it indicates the progress of formatting on only groups, and indicates that the group certification flag is effective. When a bit b1 representing user certification is "0b", it indicates that a disc has never been certified by a user, and when the bit b1 is "1b", it indicates that a disc has been certified one or more times by a user. When a bit b0 representing disc manufacturer certification is "0b" it indicates that a disc has never been certified by a manufacturer, and when the bit 0 is "1b", it indicates that the disc has been certified one or more times by the manufacturer. Other bits b4, b3, and b2 are reserved. However, "in-process" is set to be "1××" by any certification before formatting, and when formatting is completed, the "in-process" is reset to be "000".

[0091] Figure 4B illustrates the structure of each of the group certification flags of the bit positions 16 through 39 shown in Figure 3. When a bit b7 among two bits b7 and b6 representing an in-process state is "0b", it indicates format completion of a corresponding group, and when the bit b7 is "1b", it indicates that the corresponding group is being formatted. When the bit b6 is "0b", it indicates that the group is being formatted using full certification, and when the bit b6 is "1b", it indicates that the group is being formatted using partial certification. When a bit b1 representing user certification is "0b", it indicates that the group has never been certified by a user, and when the bit b1 is "1b", it indicates that the group has been certified one or more times by a user. Other bits b5, b4, b3, b2, and b0 are reserved.

[0092] Figure 5 is a table showing the contents of a secondary defect list (SDL). RBP is the position of a relative byte starting with 0. Relative byte positions 0 and 1 are SDL identifiers, and relative byte positions 2 and 3 are reserved. Relative byte positions 4 through 7 denote the total number of updated SDL blocks, and SDL updating counter values increases by one whenever the content of SDL is updated. Relative byte positions 8 through 15 denote spare area full flags, and relative byte positions 16 through 19 denote DDS/PDL updating counter values each indicating the total number of times the DDS/PDL block is updated and rewritten. The counter value is set to be "0" when initialization starts, and increases by 1 whenever the DDS/PLD is updated or

rewritten. As mentioned above, all the DDS/PDL and SDL blocks must have the same count value after formatting is finished. Relative byte positions 20 and 21 are reserved, and relative byte positions 22 and 23 indicate the number of entries in the SDL. The remaining relative byte positions indicate each SDL entry.

[0093] Figure 6 illustrates the structure of the spare area full flag of the relative byte positions 8 through 15 shown in Figure 5. In Figure 6, if a bit representing a corresponding group is "1", it indicates that no spare blocks are left in the corresponding group, and if the bit is "0", it indicates that a spare block remains in the corresponding group.

[0094] Figure 7 illustrates the structure of the SDL entry shown in Figure 5. In Figure 7, FRM is a bit representing whether a defective block has been replaced. When the defective block has been replaced, FRM records a binary "0", and when the defective block has not been replaced or no spare areas exist, FRM records a binary "1". The SDL entry includes the sector number of the first sector of a defective block, and the sector number of the first sector of a replacement block. Here, if the defective block has not been replaced, a hexadecimal "000000" is recorded in an area where the first sector number of the replacement block is recorded.

[0095] Meanwhile, in real time recording, whether corresponding data can be processed within a given time becomes more important than some errors of real data. In particular, in the case of an image or the like, an error is generated to part of a screen when a small error exists in the image. On the other hand, when input data cannot be processed in time, continuous data error is generated to make normal reproduction impossible. Therefore, the processing of data in time is more important.

[0096] Thus, as for the real time recording, a method allowing non-use of the linear replacement must be suggested. When the linear replacement is not used, there must be a portion recording the fact that a corresponding disc is in use without using the linear replacement. A method of recording such a content will be described referring to Figures 8A and 8B.

[0097] Figures 8A and 8B illustrate the structures of the disc certification flag and the group certification flag of the DDS proposed by the present invention to record real time data, respectively. The structures of the disc certification flag and the group certification flag of Figures 8A and 8B are the same as those of Figures 4A and 4B except for a bit position b2. That is, as shown in Figure 8A, when the entire corresponding disc is used without the linear replacement, the bit position b2 of the disc certification flag is set as "1", and when the corresponding disc is used by the linear replacement as in the prior art, the bit position b2 is set as "0". In Figures 8A and 8B, information associated with use or non-use of the linear replacement stored in the bit position 2(b2) is called a disc defect management mode.

[0098] Also, when only specific groups are partially initialized to prevent the linear replacement, as shown in Figure 8B, the bit position 2(b2) of the group certification flag for a corresponding group is set as "1" to indicate that linear replacement is not performed on a data region in the corresponding group. In an embodiment of the present invention, the bit positions 2(b2) of the disc certification flag and the group certification flag are used as shown in Figures 8A and 8B, but another reserved bit can be used. Here, each existing b2 region is reserved, and its value is recorded as "0".

[0099] When the bit b2 for a disc defect management mode of the disc certification flag or group certification flag is set as "1" upon initialization of a disc, the SDL records only the start sector address of a block having a defect generated during use of the disc, records an FRM bit of the SDL entry as "1", and the linear replacement is not performed. A hexadecimal "000000" is recorded in an area for recording the first sector number of a replacement block of the SDL entry.

[0100] In this way, while compatibility between a defect managing method based on a current DVD-RAM standard and a method of the present invention is maintained, i.e., while a method capable of indicating the existence of non-linearly-replaced blocks as in an existing defect managing method is suggested, a method allowing a defective block not to be linearly replaced is also provided to thereby accomplish recording and reproduction of real time data.

[0101] A determination of whether a defective region will be replaced by a block existing in a spare area using linear replacement is made by information associated with use or non-use of linear replacement defect management recorded in a defect management region on the entire disc or a specific area of the disc regardless of the type of data to be recorded in a corresponding area.

[0102] Also, a determination of whether a defective region will be replaced by a block existing in a spare area using the linear replacement is made by information associated with use or non-use of linear replacement defect management recorded in a defect management region on the entire disc or in a specific area on the disc in the case of only data required to be recorded in real time.

[0103] A method of preventing linear replacement with respect to the entire disc or a specific group of discs was described on the basis of the above-described embodiment. In another embodiment, when a disc defect management mode is set as "1", it can be used as information that the linear replacement is not performed with respect to a block having a defect in an area of a disc for recording information requiring real time recording and reproduction, but the linear replacement can be performed with respect to an area of a disc not requiring real time recording. In this case, when data not requiring real time recording has already been recorded in an area in which real time data must be recorded, and a defective region is thus linearly replaced, the linear replacement of the defective region must be capable of

being canceled. Therefore, when the disc defect management mode is set as "1", this can mean that the linear replacement of the defect can be cancelled when real time information is recorded.

[0104] In order to prevent entire linear replacement with respect to the entire disc or a given group on the disc, information associated with the disc defect management mode is set as "1" upon initialization. On the other hand, when linear replacement is not performed only in the case of recording real time data, there is no need to set the defect management mode information upon initialization. That is, when it is determined that there is a necessity for recording real time data in a disc, the disc defect management mode is set as "1" just before the real time data is recorded. At this time, a determination of whether a corresponding disc is suitable for recording real time data is made on the basis of the amount or distribution of a defect generated on the disc. When it is determined that the disc is suitable, the disc defect management mode is set as "1". Otherwise, a process for informing a user that the disc is not suitable for recording real time data is required.

[0105] Figure 9 is a flowchart illustrating a method of recording data in real time without performing defect management using linear replacement with respect to only data desired to be recorded when the disc defect management mode is "1".

[0106] In Figure 9, first, a determination of whether a disc defect management mode is "1" is set before recording of data on a disc begins, in step S101. If the disc defect management mode is "1", it is determined whether data to be recorded is real time data, in step S103. If the defect management mode is "0", every data is recorded on the basis of a general defect managing method defined in the standard book version 1.0, in steps S102 and S108. When it is determined in step S103 that data to be recorded is not real time data, step S102 of performing general defect management is performed. When it is determined in step S103 that data to be recorded is real time data, it is determined whether an already-linearly-replaced defect exists in an area where data is to be recorded, in step S104.

[0107] When it is determined in step S104 that the linearly replaced defect exists in the area to record data in, the linearly-replaced defect is canceled, in step S105. When no linearly-replaced defect exists in the area to record data in, it is determined whether a newly-detected defect exists in the area to record data in, in step S106.

[0108] When it is determined in step S106 that a new defect is detected, information representing that a defect has not been linearly replaced is recorded in a secondary defect list (SDL) of a defect management area, in step S107. Next, data is recorded in a desired area in step S108. Also, when a new defect is not detected in step S106, step S108 of recording real time data in a desired region is performed.

[0109] Step S105 of cancelling a linearly-replaced defect, and step S107 of recording information representing that a defect has not been linearly replaced are performed by recording the first sector number of a replacement block as a hexadecimal "000000", among linearly-replaced defect information recorded in the SDL, and by recording the FRM information as "1". In this case, since the disc defect management mode is set as "1", it can be recognized from the comparison of this mode information with FRM information that the meaning of the FRM information becomes different from that of existing FRM information.

[0110] That is, the FRM information based on the existing standard book denotes that a block having a defect generated for a certain reason has not been replaced with a block in a spare area or no spare areas can be replaced. On the other hand, FRM information based on a new definition is added to the meaning of the existing FRM and can be information representing that when the disc defect management mode is "1", the linear replacement of a defective block replaced by an existing linear replacement method has been cancelled for real time recording, or the defective block has not been linearly replaced for real time recording.

[0111] Since a disc whose defect management mode is set as "1" is likely to include real time information, the disc can be utilized as information of prohibiting reallocation of information on a disc without consideration of real time information. Piece collection of collecting the pieces of a file on a disc, and read after reallocation can be included as a method of reallocating the information on a disc. The read after allocation is a method of reading data and then replacing a data block likely to have a defect with a block located in a spare area.

[0112] Figure 10 illustrates the structure of an improved SDL entry for cancelling linear replacement proposed by the present invention. When an already-replaced defect exists on a corresponding disc upon recording of real time data, a method of recording the information of an area, in which the first sector number of the replacement block as described above is recorded, as a hexadecimal "000000" and setting an FRM bit as "1" is exemplified as a process for cancelling the linear replacement.

[0113] This method can minimize the change in the existing standard. However, in this method, the information of a block which is determined as defective and replaced must be deleted, so that linear replacement may be arbitrarily performed, cancelled, and again performed without sequentially using a spare area. In particular, when a linearly-replaced block in the spare area is defective and again replaced, information associated with the linearly-replaced defective block in the spare area is lost.

[0114] Thus, it would be preferable that blocks in a corresponding spare area are sequentially used when linear replacement occurs, and that even when the linear replacement is cancelled, information associated with a block in the spare area replacing a corresponding

defect block is maintained. When only a region recording an FRM bit and the first sector number of a replacement block is used to maintain information associated with the replaced sector number of the spare area, it is not possible to tell if the corresponding replaced block has again been replaced on account of a defect or if the linear replacement has been cancelled to record real time data.

[0115] In order to solve such a problem, a cancelled linear replacement (CLR) flag is newly defined by using a spare bit of the SDL entry which is not in use. When linear replacement with respect to a corresponding SDL entry is cancelled for recording real time data, a method of setting the CLR flag as "1" can be used. Here, when the CLR flag is set as "0", it indicates a replacement block allocated without being used by real time data. In the structure of an SDL entry of Figure 10, for example, a bit b31 not in use is used as the CLR flag.

[0116] Meanwhile, defect management information for recording real time data can be roughly divided into three cases in which: (1) real time data is not recorded on the entire disc; (2) two types of data, i.e., real time data and non-real time data, coexist on a disc, and a linear replacement defect managing method is not used with respect to only the real time data; and (3) only the real time data is recorded in the entire disc, i.e., the linear replacement defect managing method is not used with respect to all recorded data.

[0117] Particularly, in the third case, real time replacement is not used for the entire disc, so that a spare area for defect management can be set to a smaller size than in the first and second cases. This will be described in detail later referring to Figures 12 and 13.

[0118] When these three or more defect managing methods are applied to one disc, various correspondences are possible according to the purpose of use of a disc, and the disc can be more effectively used. However, considering a condition such as the case of changing and using discs between reproduction apparatuses, the defect management conditions in which a corresponding disc is used must be described in more detail. 1-bit disc defect management mode information representing use or non-use of linear replacement described in Figure 8 is deficient for defect management information in the above case.

[0119] Thus, as shown in Figure 11, defect management mode information capable of representing linear replacement or non-linear replacement depending on a plurality of different defect management modes is stored in a reserved byte located in the DDS of the defect management area (DMA) on a disc. That is, Figure 11 shows the case of using two significant bits b7 and b6 of the relative byte position BP10 of DDS, i.e., the eleventh byte thereof, by taking defect management (DM) mode depending on use or non-use of linear replacement as an example.

[0120] As shown in Figure 11, when the DM mode information is "00b", it indicates that the slipping replacement and the linear replacement are applied to all data on a disc, when the DM mode information is "01b", it indicates that the linear replacement is selectively applied according to the type of information (here, real time data and non-real time data), and when the DM mode information is "10b", it indicates that the linear replacement is not used with respect to every data.

[0121] That is, when the DM mode information is "00b", the slipping replacement and the linear replacement are mandatory, and this mode is only for data other than real time data in the first case described above. When the DM mode information is "01b", the linear replacement is mandatory, but the linear replacement for real time data is optional. This mode is defect management for a hybrid disc including both real time data and non-real time data in the second case described above. When the DM mode information is "10b", only the slipping replacement is allowable, and this mode is defect management for only real data in the third case described above. When the DM mode information is "10b", the physical layout of a disc can be changed.

[0122] Meanwhile, since linear replacement cannot be used to record real time data, a spare area necessary for linear replacement does not actually become necessary. For this case, in the present invention, only a spare area for slipping replacement is set in the last group without allocating a spare area for linear replacement as shown in Figure 12. In particular, the spare area set in the last group (here, a thirty fourth group) allocates 7680 sectors (480 ECC blocks) to a spare area for slipping replacement to process a maximum of 7679 entries capable of being registered in a primary defect list (PDL). In Figure 12, sect denotes a sector, blk denotes block, and rev denotes revolutions.

[0123] In order to obtain the compatibility between the present invention and an existing defect management structure, a flag, capable of discriminating a case in which spare areas for only slipping replacement are allocated only for real time recording from a case in which spare areas for linear replacement and slipping replacement are allocated according to an existing defect management method, is represented with significant bits b7 and b6 of the relative byte position BP 10 in the DDS and the PDL, as shown in Figure 13.

[0124] As shown in Figure 13, when two significant bits b7 and b6 representing a DM mode on the byte position BP 10 of the DDS/PDL are "00b", it indicates that an existing defect managing method is applied, and when the two significant bits b7 and b6 are "10b", a defect managing method for only real time recording without linear replacement, in which only the spare area for slipping replacement is allocated in the last group of a disc, is applied. Thus, spare areas are allocated by a method dedicated for real time recording, thereby increasing the efficiency due to the application of the space of a disc.

[0125] As described above, while compatibility between a method of the present invention and a defect

managing method based on the current DVD-RAM standard is maintained, linear replacement is not performed when real time data is recorded. Thus, real time data can be recorded and reproduced.

[0126] In embodiments of the present invention, information representing a plurality of different defect management modes depending on the type of data to be recorded is stored, so that various correspondences are possible according to the purpose of use of the recording medium. Thus, the recording medium can be more effectively used.

[0127] Also, in embodiments of the present invention, when real time data is recorded, spare areas are allocated to be used for only real time. Thus, the effectiveness due to the application of the space of a disc can be increased.

[0128] The reader's attention is directed to all papers and documents which are filed concurrently with or previous to this specification in connection with this application and which are open to public inspection with this specification, and the contents of all such papers and documents are incorporated herein by reference.

[0129] All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

[0130] Each feature disclosed in this specification (including any accompanying claims, abstract and drawings), may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

[0131] The invention is not restricted to the details of the foregoing embodiment(s). The invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed.

Claims

1. A defect managing method for a disc recording and/or reproducing apparatus, comprising the steps of:

   (a) recording information representing use or non-use of linear replacement defect management with respect to an entire disc or a specific area of the disc on the disc; and
   (b) determining whether a defective area of the disc is to be replaced by a block in a spare area of the disc using linear replacement according to the information representing use or non-use of the linear replacement defect management.

2. The defect managing method as claimed in claim 1, wherein said step (a) comprises recording the information representing use or non-use of linear replacement for the entire disc in a reserved area of a disc certification flag in a disc definition structure (DDS) of the disc, wherein the disc is a digital versatile disc-random access memory (DVD-RAM) disc.

3. The defect managing method as claimed in claim 1, wherein said step (a) comprises recording the information representing use or non-use of linear replacement for the specific area of the disc in a reserved area of a group certification flag in a disc definition structure (DDS) of the disc, wherein the disc is a digital versatile disc-random access memory (DVD-RAM) disc.

4. The defect managing method as claimed in any one of the above claims, wherein said step (a) comprises recording the information representing use or non-use of linear replacement upon initialization of the disc.

5. The defect managing method as claimed in any one of the above claims, wherein said step (a) comprises recording the information representing use or non-use of linear replacement just before real time data is recorded on the disc.

6. The defect managing method as claimed in any one of the above claims, wherein the information representing use or non-use of linear replacement is information for showing a plurality of defect management modes, and is recorded in a reserved area of a disc definition structure (DDS) of the disc.

7. The defect managing method as claimed in claim 6, wherein the information showing the plurality of defect management modes includes information representing that slipping replacement and linear replacement are applied with respect to all data to be recorded in a user data area on the disc, information representing that linear replacement is selectively applied according to type of the data on the disc, and information representing that linear replacement is not applied to all the data to be recorded in the recording area on the disc.

8. The defect managing method as claimed in any one of the above claims, wherein the information representing use or non-use of linear replacement indicates use of a defect managing method dedicated for real time recording in which linear replacement is not performed by allocating only a spare area for slipping replacement.

9. The defect managing method as claimed in claim

8, wherein the spare area for slipping replacement is allocated to a last group of the disc, and the information representing use or non-use of linear replacement is recorded in a reserved area of each of a disc definition structure (DDS) and a primary defect list (PDL) of the disc.

10. The defect managing method as claimed in any one of the above claims, wherein in said step (b) in response to the information representing use or non-use of linear replacement representing the non-use of linear replacement, the defect managing method comprises not using linear replacement for real time data to be recorded on the disc, and using linear replacement for data to be recorded on the disc other than the real time data.

11. The defect managing method as claimed in any one of the above claims, wherein in step (b) in response to the information representing use or non-use of linear replacement represents the non-use of linear replacement, the defect managing method comprises not using linear replacement regardless of whether data to be recorded on the disc is real time data.

12. The defect managing method as claimed in any one of the above claims, further comprising the step of:

(c) cancelling the linear replacement of a defect on an area of the disc where real time data is to be recorded, in response to the information representing use or non-use of linear replacement representing the non-use of linear replacement.

13. The defect managing method as claimed in claim 12, wherein said step (c) comprises cancelling the linear replacement using a flag representing that the linear replacement has been cancelled using a reserved bit in a secondary defect list (SDL), storing information representing that the defective block has been replaced in a Forced Re-Assignment Marking (FRM) bit of the SDL, and storing a start sector number of the defective block and a start sector number of the replacement block in the SDL.

14. The defect managing method as claimed in claim 12, wherein said step (c) comprises leaving only a start sector number of the defective block in a secondary defect list (SDL), storing information representing that the defective block has not been replaced in a Forced Re-Assignment Marking (FRM) bit of the SDL showing whether the defective block has been replaced, and storing information representing that the defective block has not been replaced in a start sector number of the replacement block in the SDL.

15. The defect managing method as claimed in any one of claims 1 to 11, further comprising the step of:

(c) recording only a start sector number of the defective block having a defect generated while using the disc on which the information that the linear replacement defect management will not be used has been recorded, in a secondary defect list (SDL), recording information representing that the defective block has not been replaced in a Forced Re-Assignment Marking (FRM) bit of the SDL showing whether the defective block has been replaced, and recording information that the defective block has not been replaced in a start sector number of the replacement block in the SDL.

16. The defect managing method as claimed in any one of claims 1 to 11, further comprising the step of:

(c) performing defect management based on linear replacement when a defect is generated during use of the disc on which the information that the linear replacement defect management will be used has been recorded.

17. A method of recording real time data while managing a defect on a disc using a disc recording and/or reproducing apparatus, the method comprising the steps of:

(a) determining whether defect management mode information representing whether defect management based on linear replacement is to be used;
(b) determining whether data to be recorded on a disc is the real time data, in response to the defect management mode information being information that the linear replacement not to be used;
(c) determining whether a linearly-replaced defect exists in an area of the disc in which the data is to be recorded, in response to the data to be recorded being the real time data; and
(d) determining whether a new defect is detected in the area in which to record the data, in response to no linearly-replaced defect existing in the area in which to record the data, and recording the real time data in a designated part of the area in which to record the data in response to the new defect not being detected.

18. The method of recording real time data as claimed in claim 17, further comprising the steps of:

(e) performing defect management in response to the defect management mode information being information representing that the linear

replacement is to be used in said step (a); and (f) performing the defect management in response to the data to be recorded not being the real time data in said step (b).

19. The method of recording real time data as claimed in claim 17, further comprising the step of:

(e) cancelling linear replacement in response to the linearly-replaced defect existing in the area in which to record the data, in said step (c).

20. The method as claimed in claim 19, wherein said step

(e) comprises the steps of leaving only a start sector number of a defective block in the SDL, storing information representing that the defective block has not been replaced in a Forced Re-Assignment Mark (FRM) bit of the SDL showing whether the defective block has been replaced, and recording information representing that the defective block has not been replaced in a start sector number of a replacement block in the SDL.

21. The method as claimed in claim 19, wherein said step

(e) comprises the steps of setting a flag representing that linear replacement has been cancelled using a reserved bit of the SDL, storing information representing that a defective block has been replaced in a Forced Re-Assignment Mark (FRM) bit of the SDL, and recording a start sector number of a defective block and a start sector number of a replacement block in the SDL.

22. The method of recording real time data as claimed in claim 17, further comprising the step of:

(e) recording information representing that linear replacement has not been performed, in response to a new defect being detected in said step (d).

23. The method as claimed in claim 22, wherein said step

(e) comprises the steps of leaving only a start sector number of a defective block in the SDL, storing information representing that the defective block has not been replaced in a Forced Re-Assignment Mark (FRM) bit of the SDL showing whether the defective block has been replaced, and recording information representing that the defective block has not been replaced in a start sector number of a replacement block in the SDL.

24. The method as claimed in any one of claims 17 to 23, wherein the disc is a digital versatile disc-random access memory (DVD-RAM) disc having a defect definition structure (DDS), and the defect management mode information is information representing use or non-use of linear replacement for the entire disc, and is stored in a reserved area of a disc certification flag in the DDS.

25. The method as claimed in any one of claims 17 to 23, wherein the disc is a digital versatile disc-random access memory (DVD-RAM) disc having a defect definition structure (DDS), and the defect management mode information is information representing use or non-use of linear replacement for only some data groups of the disc, and is stored in a reserved area of a group certification flag in the DDS.

26. The method as claimed in any one of claims 17 to 25, wherein the defect management mode information includes information representing that slipping replacement and linear replacement are applied to all the data to be recorded on the disc, information representing that linear replacement is selectively applied according to type of data, or information representing that linear replacement is not applied to all the data to be recorded on the disc, and the defect management mode information is stored in a reserved area of the DDS.

27. The method as claimed in any one of claims 17 to 25, wherein the disc is a digital versatile disc-random access memory (DVD-RAM) disc having a defect definition structure (DDS) and a primary defect list (PDL), and the defect management mode information is information representing the use of a defect managing method for only real time recording in which linear replacement is not used by allocating only the spare area for slipping replacement, and is stored in a reserved area of the DDS and a reserved area of the PDL.

FIG. 1

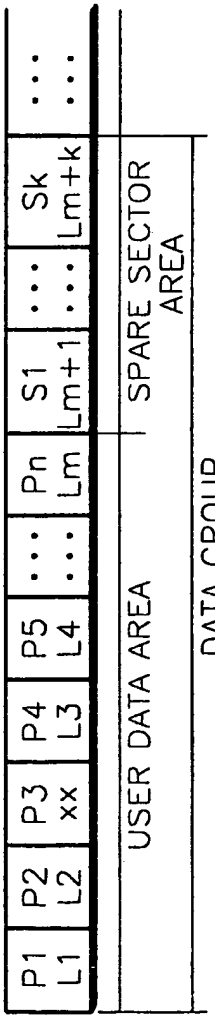

P1 L1
P2 L2
P3 xx
P4 L3
P5 L4
...
Pn Lm
S1 Lm+1
...
Sk Lm+k
...
USER DATA AREA
SPARE SECTOR AREA
DATA GROUP

FIG. 2

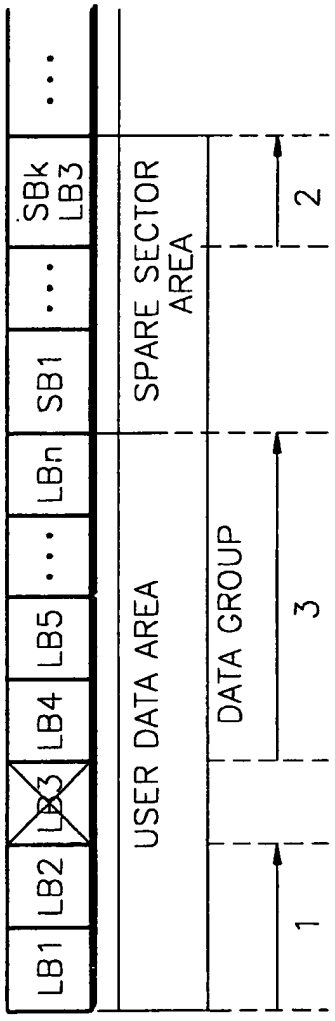

LB1
LB2
LB3
LB4
LB5
...
LBn
SB1
...
SBk LB3
...
USER DATA AREA
SPARE SECTOR AREA
DATA GROUP
1
2
3

FIG. 3

BP	Contents	Number of bytes
0 to 1	DDS Identifier(0A0Ah)	2bytes
2	Reserved	1bytes
3	Disc certification Flag	1bytes
4 to 7	DDS/PDL, update counter	4bytes
8 to 9	Number of Groups	2bytes
10 to 15	Reserved	6bytes
16	Group certification for Group0	
17	Group certification for Group1	
. . .	. . .	
39	Group certification for Group23	
40 to 79	Reserved	64bytes
80 to 2047	Reserved	1968bytes

FIG. 4A

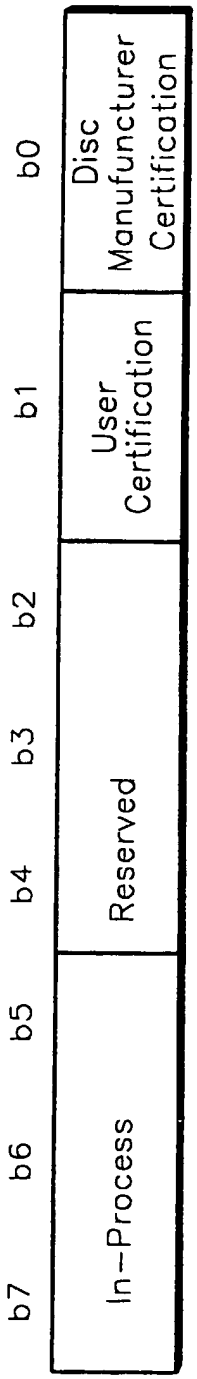

b7
b6
b5
b4
b3
b2
b1
b0
In-Process
Reserved
User Certification
Disc Manufuncturer Certification

FIG. 4B

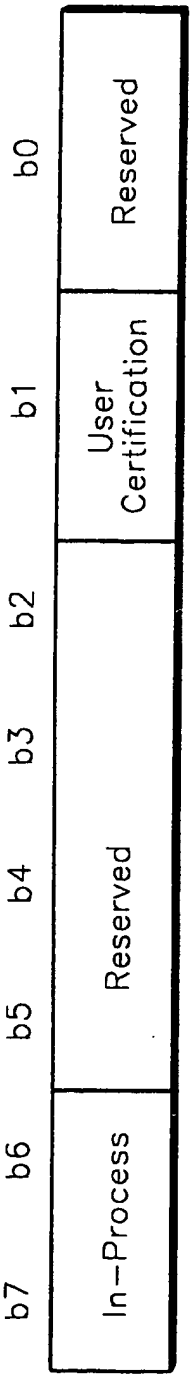

b7
b6
b5
b4
b3
b2
b1
b0
In-Process
Reserved
User Certification
Reserved

FIG. 5

BP	Contents	Number of bytes
0 to 1	SDL Identifier(0002h)	2bytes
2 to 3	Reserved	2bytes
4 to 7	SDL update counter	4bytes
8 to 15	Spare area full flag	8bytes
16 to 19	DDS/PDL, update counter	4bytes
20 to 21	Reserved	2bytes
22 to 23	number of SDL entries	2bytes
24 to 31	first SDL entry	8bytes
. . .	. . .	. . .
m to m+7	last SDL entry	8bytes

FIG. 6

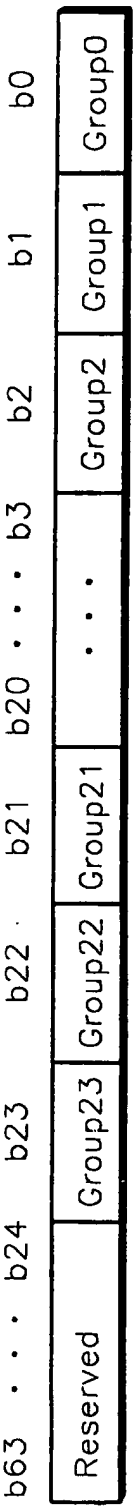

b63 . . . b24 b23 b22 b21 b20 . . . b3 b2 b1 b0
Reserved
Group23
Group22
Group21
. . .
Group2
Group1
Group0

FIG. 7

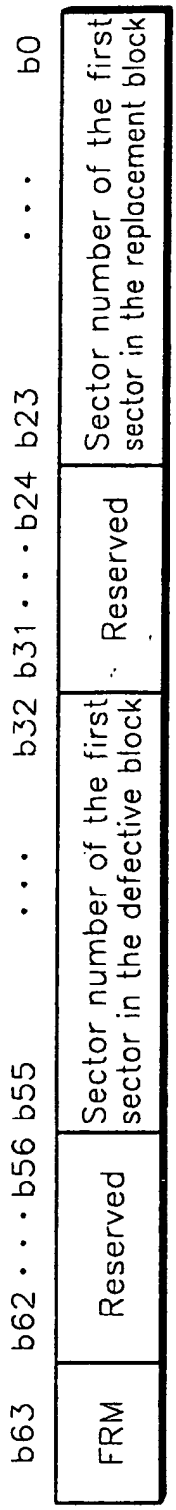

b63 b62 . . . b56 b55 . . . b32 b31 . . . b24 b23 . . . b0
FRM
Reserved
Sector number of the first sector in the defective block
Reserved
Sector number of the first sector in the replacement block

FIG. 8A

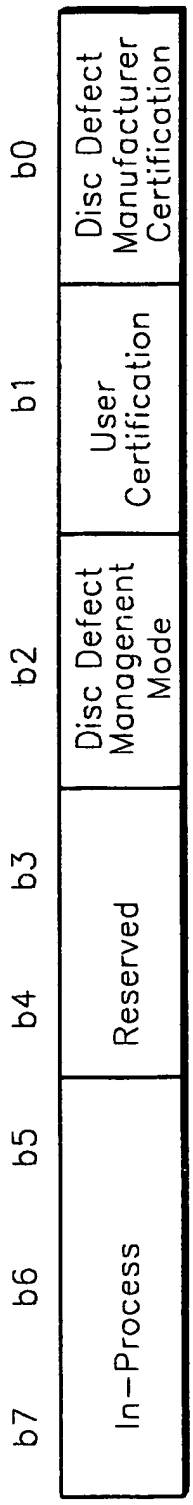

b7
b6
b5
b4
b3
b2
b1
b0
In-Process
Reserved
Disc Defect Managenent Mode
User Certification
Disc Defect Manufacturer Certification

FIG. 8B

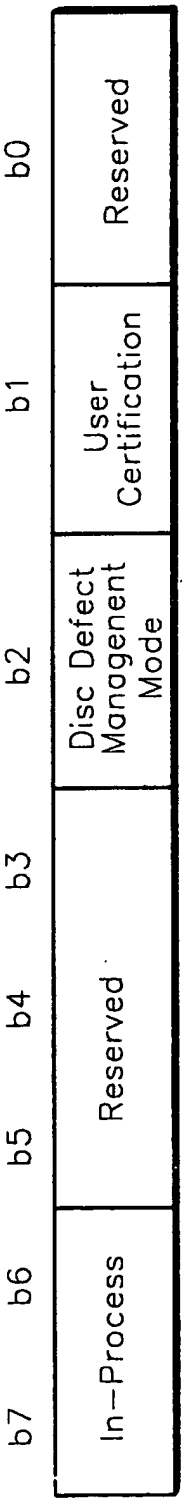

b7
b6
b5
b4
b3
b2
b1
b0
In-Process
Reserved
Disc Defect Managenent Mode
User Certification
Reserved

FIG. 9

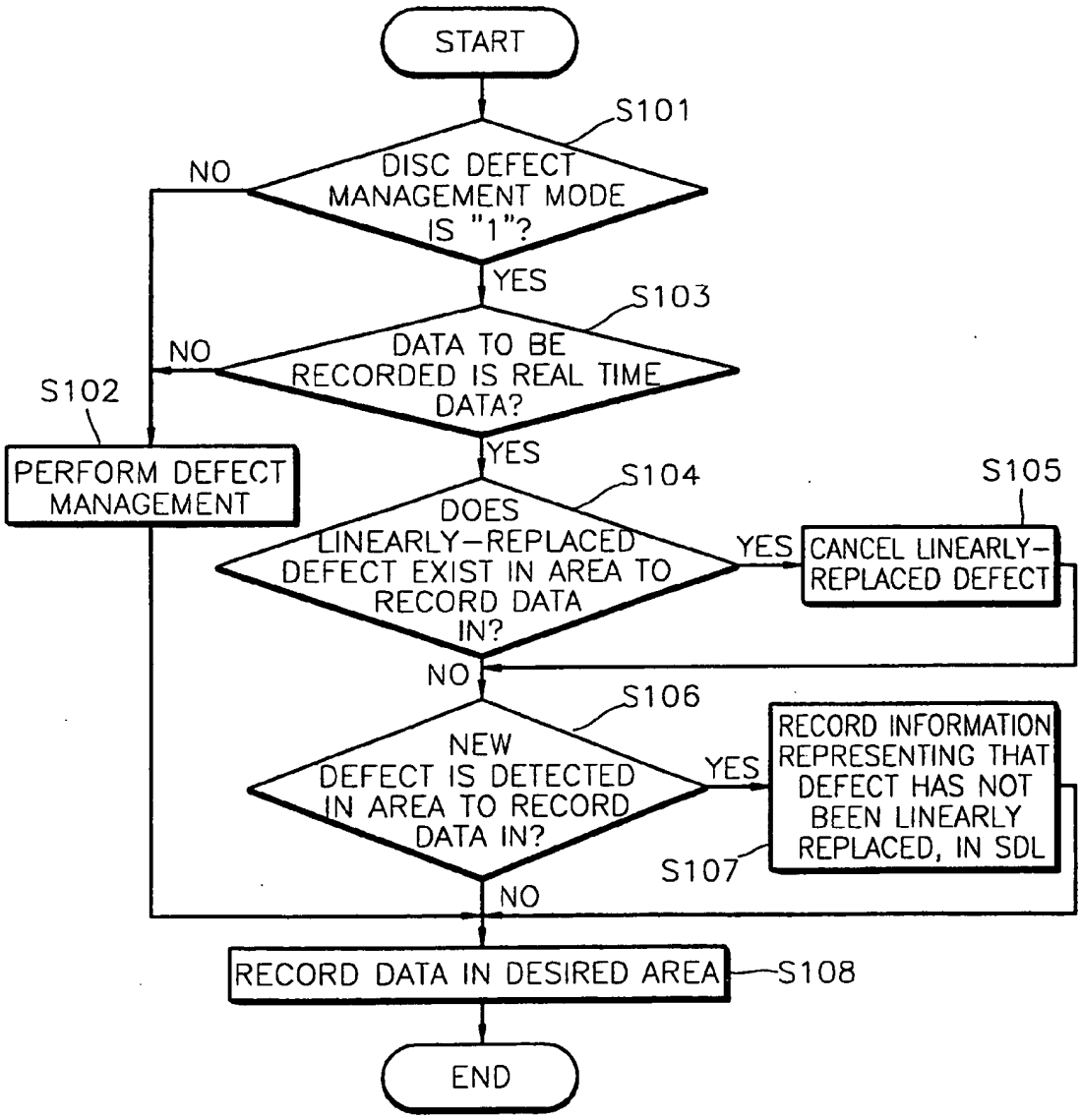

START
S101
DISC DEFECT MANAGEMENT MODE IS "1"?
NO
YES
S103
DATA TO BE RECORDED IS REAL TIME DATA?
NO
YES
S102
PERFORM DEFECT MANAGEMENT
S104
DOES LINEARLY-REPLACED DEFECT EXIST IN AREA TO RECORD DATA IN?
YES
S105
CANCEL LINEARLY-REPLACED DEFECT
NO
S106
NEW DEFECT IS DETECTED IN AREA TO RECORD DATA IN?
YES
RECORD INFORMATION REPRESENTING THAT DEFECT HAS NOT BEEN LINEARLY REPLACED, IN SDL
S107
NO
RECORD DATA IN DESIRED AREA
S108
END

FIG. 10

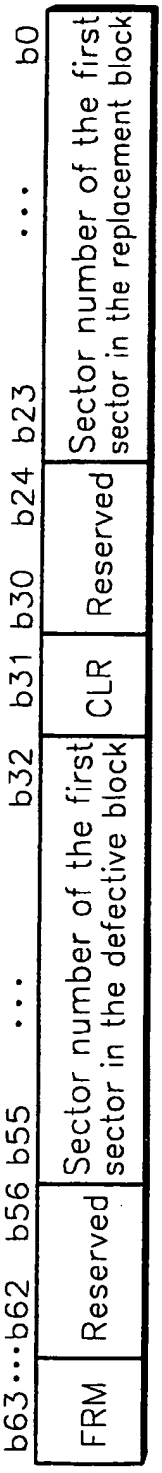

b63...b62
b56
b55
...
b32
b31
b30
b24
b23
...
b0
FRM
Reserved
Sector number of the first sector in the defective block
CLR
Reserved
Sector number of the first sector in the replacement block

FIG. 11

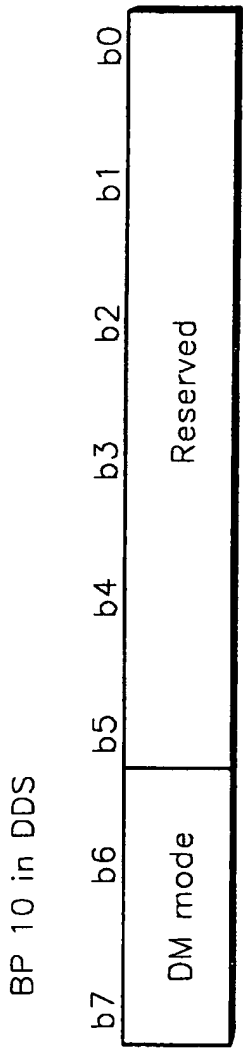
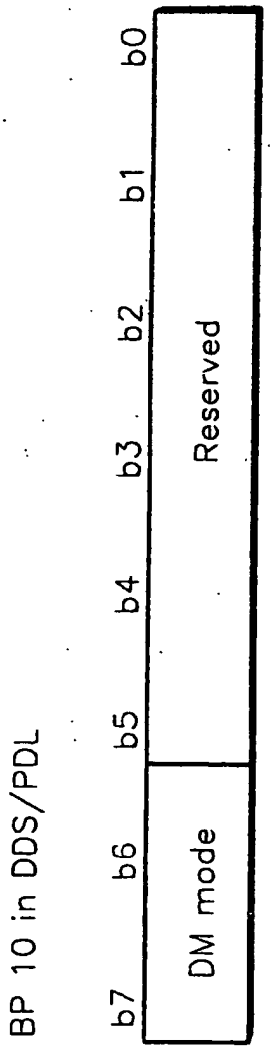

BP 10 in DDS
b7
b6
b5
b4
b3
b2
b1
b0
DM mode
Reserved

FIG. 12

Zone	# of sect per rev	Start Sector Number (Hex)	Guard Area	# of Guard blk	Group No.	User Area		Spare area		Guard area	End sector number
						Sector number	# of blk	Sector number	#of blk		
0	25	31000	–	0	0	31000 – 398DF	2190	–	0	398E0 – 3991F	3991F
1	26	39DD0	39920 – 3995F	4	1	39960 – 4381F	2540	–	0	43820 – 4385F	4385F
2	27	441F0	43860 – 4389F	4	2	438A0 – 4DD7F	2638	–	0	4DD80 – 4DDBF	4DDBF
3	28	4EC60	4DDC0 – 4DDFF	4	3	4DE00 – 588FF	2736	–	0	58900 – 5893F	5893F
4	29	59D20	58940 – 5897F	4	4	58980 – 63A9F	2834	–	0	63AA0 – 63ADF	63ADF
5	30	65430	63AE0 – 63B1F	4	5	63B20 – 6F25F	2932	–	0	6F260 – 6F29F	6F29F
6	31	71190	6F2A0 – 6F2DF	4	6	6F2E0 – 7B03F	3030	–	0	7B040 – 7B07F	7B07F
7	32	7D540	7B080 – 7B0BF	4	7	7B0C0 – 8743F	3128	–	0	87440 – 8747F	8747F
8	33	59F40	87480 – 874CF	5	8	874D0 – 93E4F	3224	–	0	93E50 – 93E9F	93E9F
9	34	96F90	93EA0 – 93EEF	5	9	93EF0 – A0E8F	3322	–	0	A0E90 – A0EDF	A0EDF
10	35	A4630	A0EE0 – A0F2F	5	10	A0F30 – AE4EF	3420	–	0	AE4F0 – AE53F	AE53F
11	36	B2320	AE540 – AE58F	5	11	AE590 – BC16F	3518	–	0	BC170 – BC1BF	BC1BF
12	37	C0660	BC1C0 – BC20F	5	12	BC210 – CA40F	3616	–	0	CA410 – CA45F	CA45F
13	38	CEFF0	CA460 – CA4AF	5	13	CA4B0 – D8CCF	3714	–	0	D8CD0 – D8D1F	D8D1F
14	39	DDFD0	D8D20 – D8D6F	5	14	D8D70 – E7BAF	3812	–	0	E7BB0 – E7BFF	E7BFF
15	40	ED600	E7C00 – E7C4F	5	15	E7C50 – F70AF	3910	–	0	F70B0 – F70FF	F70FF
16	41	FD280	F7100 – F715F	6	16	F7160 – 106DBF	4006	–	0	106BC0 – 106C1F	106C1F
17	42	10D550	106C20 – 106C7F	6	17	106C80 – 116CFF	4104	–	0	116D00 – 116D5F	116D5F
18	43	11DE70	116D60 – 116DBF	6	18	116DC0 – 12745F	4202	–	0	127460 – 1274BF	1274BF
19	44	12EDE0	1274C0 – 12751F	6	19	127520 – 1381DF	4300	–	0	1381E0 – 13823F	13823F
20	45	1403A0	138240 – 13829F	6	20	1382A0 – 14957F	4398	–	0	149580 – 1495DF	1495DF
21	46	151FB0	1495E0 – 14963F	6	21	149640 – 15AF3F	4496	–	0	15AF40 – 15AF9F	15AF9F
22	47	164210	15AFA0 – 15AFFF	6	22	15B000 – 16CF1F	4594	–	0	16CF20 – 16CF7F	16CF7F
23	48	176AC0	16CF80 – 16CFDF	6	23	16CFE0 – 17F51F	4692	–	0	17F520 – 17F57F	17F57F
24	49	1899C0	17F580 – 17F5EF	7	24	17F5F0 – 19212F	4788	–	0	192130 – 19219F	19219F
25	50	19CF10	1921A0 – 19220F	7	25	192210 – 1A536F	4886	–	0	1A5370 – 1A53DF	1A53DF
26	51	1B0AB0	1A53E0 – 1A544F	7	26	1A5450 – 1B8BCF	4984	–	0	1B8BD0 – 1B8C3F	1B8C3F
27	52	1C4CA0	1B8C40 – 1B8CAF	7	27	1B8CB0 – 1CCA4F	5082	–	0	1CCA50 – 1CCABF	1CCABF
28	53	1D94E0	1CCAC0 – 1CCB2F	7	28	1CCB30 – 1E0EEF	5180	–	0	1E0EF0 – 1E0F5F	1E0F5F
29	54	1EE370	1E0F60 – 1E0FCF	7	29	1E0FD0 – 1F59AF	5278	–	0	1F59B0 – 1F5A1F	1F5A1F
30	55	203850	1F5A20 – 1F5A8F	7	30	1F5A90 – 20AA8F	5376	–	0	20AA90 – 20AAFF	20AAFF
31	56	219380	20AB00 – 20AB6F	7	31	20AB70 – 22018F	5474	–	0	220190 – 2201FF	2201FF
32	57	22F500	220200 – 22027F	8	32	220280 – 235E9F	5570	–	0	235EA0 – 235F1F	235F1F
33	58	245CD0	235F20 – 235F9F	8	33	235FA0 – 24C1DF	5668	–	0	24C1E0 – 24C25F	24C25F
34	59	25CAF0	24C260 – 24C2DF	8	34	24C2E0 – 26329F	5884	2632A0 – 26509F	480	–	26509F

FIG. 13



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EUROPEAN SEARCH REPORT

Application Number
EP 02 02 6964

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A	WO 98 14938 A (FUKUSHIMA YOSHIHISA ;GOTOH YOSHIHO (JP); UEDA HIROSHI (JP); MATSUS) 9 April 1998 (1998-04-09) * abstract *	1-27	TECHNICAL FIELDS SEARCHED (Int.Cl.7)
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The present search repon has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	4 February 2003	Barel-Faucheux, C

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
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